VIA ELECTRONIC FILING

February 14, 2019

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: Ex Parte Presentation, Notice of Inquiry on Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz. GN Docket No. 17-183

Dear Ms. Dortch:

On February 12, 2019, the following representatives from the Ultra Wide Band Alliance ("UWB Alliance"), and associates met with staff from the FCC's Wireless Office of Engineering and Technology (OET) to discuss the above-referenced proceeding.

Representatives from UWB Alliance included Tim Harrington and Ben Rolfe; Kelli Emerick and Marc-Anthony Signorino (121 Strategies, consultant to UWB Alliance); Jackie Green, Alteros; Bob Silverman, Womble Bond Dickinson (US) LLC, representing Alteros; Brian Laughlin, Bosch; Chris Imlay, with Booth, Freret & Imlay, LLC representing Bosch; Dries Neirynck, DecaWave; Erik Steltz and Tonya Drake, iRobot; and Ed Richley, Zebra. Identified representatives from OET included Julius Knapp, Aspasia Paroutsas, Michael Ha, and Paul Murray. During the meeting, UWB Alliance discussed a proposal for spectrum coexistence that would allow for more flexible use in the 6 GHz band, while protecting incumbent licenses users and existing unlicensed UWB users. A visual presentation was also provided during the meeting, which has been attached to this letter.

UWB Alliance representatives explained that current proposed unlicensed broadband deployment, at the requested power levels, bandwidth, and OOBE would effectively render many UWB products, services and applications useless. UWB Alliance asked the FCC to consider mitigation solutions that will continue to allow for unlicensed UWB technologies to successfully coexist with incumbent users in the 6 GHz band and provide valuable functionality.

Respectfully Submitted,

Timothy Harrington
Executive Director
UWB Alliance

Presentation to FCC Office of Engineering and Technology (OET)

February 12, 2019

UWB ALLIANCE

Who Are We and Why Are We Here?

UWB Alliance – Who are we… *today*?

Why are we here?

- Unlicensed broadband is an expanding essential technology
- So is UWB!

- We have serious concerns about the proposed rules interfering much more than anticipated with consumer, commercial, medical, and scientific applications in the 6 GHz spectrum

- We want to explore opportunities for mutual co-existence

UWB – innovative and unique

- UWB radio offers advantages over carrier-based transmission technologies (Wi-Fi/Bluetooth/etc.)
  - Field proven coexistence with current 6-7 GHz users
  - Ultra Wide Bandwidth yields extremely precise ranging, tracking and material/object sensing
  - UWB signals and modulations require much less power
    - Allows for multi-year battery operated devices with coin cell
    - Smallest form factor devices (e.g., fits under a shoulder pad or in a football)
  - Instantaneous motion detection for advanced IoT uses
  - Virtually eliminates multipath issues
  - Very low power transmissions provide high device density
  - Highly resistant to hacking and hijacking
  - Real-time full frequency audio for entertainment and gaming
  - **Best suited to support the explosion of IOT devices**

UWB – it's already big, about to get much bigger

- Consumer UWB devices already exist (Many comply with IEEE 802.15.4)
  - Automotive radar ranging systems
  - Baby, sleep apnea, and pulse monitoring
  - Radars for wall exploration
  - Robotic lawn mower for sale this year
  - Fall monitoring
  - Universal IOT Remote
- Commercial applications of UWB are common
  - Professional audio
  - Sports tracking (NFL)
  - Industrial asset tracking
  - Automotive and industrial production automation
  - Stock animal health and tracking
  - Tank level radar sensing
  - Airport baggage handling
  - Bus and train control and communication
- Many more applications are coming fast
  - IEEE TG4z Enhanced Impulse Radio is the most well attended TG in 802.15 Working Group
  - Highly secure wireless entry fobs for vehicles and home entry
  - Smartphone Ecosystems
    - Watches, Secure automated entry, Fitness trackers, Automated "Follow-me", Pet tracking, Etc.

Why not just move?

- **No Place To Go**
  - **Most Products certified under Part 15.250**
    - **15.250 allows indoor/outdoor use with no 10 s rule or restrictions as to class of service**
  - **Part 15.250 stops at 7.250 GHz and Can't Go Higher because of Government Use restricted Band**
  - **Some Licensed and Unlicensed Production Wireless Devices have already moved 2 other times and this is the "last stop"**
- Disruption Of Operations Of Installed Base
  - The installed Base is consists of millions of devices which are in daily use – Most centered at 6.5 GHz
  - The threat of change is already damaging business
- Performance Risk:
  - Current Part 15 unlicensed devices are effective and proven to successfully share the 6-7 GHz spectrum with incumbent users
  - Potential bands for UWB (10 GHz?) would have vastly different characteristics
    - As any technical Wi-Fi user knows, 2.4 GHz *does not equal* 5.8 GHz
- Other Concerns
  - Time
    - Successful technology innovation takes time
  - Expense
    - Hundreds of millions of dollars invested to bring Part 15 unlicensed devices to market: relocating is not economically viable
  - Discourages Innovation:
    - Large investments made in 6 GHz UWB: Investment cycle must start all over
    - U-NII based modulations do not allow new innovation to flourish

Coexistence suggestion 1

- Authorize new unlicensed Broadband to 5.925 - 6.1 GHz
  - Exceeds 100+55 MHz mandated by the MOBILE NOW Act
  - Will inspire innovation and conservative use of the available bandwidth
  - Provides open field for incumbent UWB, FSS, FS and Scientific Users

AND

- Specify OOBE to -61 dBm/MHz
  - Proposed NPRM limit is higher than mean UWB transmit power making co-existence impossible across all bands
    - Current NPRM is -27 dBm/MHz while UWB is allowed *intentional* at -41.3dBm/MHz
  - A tight OOBE mask is a key technical tool for maximizing capacity and band sharing

Coexistence suggestions 2

- Restrict duty cycle of each 6 GHz transmitter to 0.5% over a period of 1 s
- Specify lower power levels which will yield more capacity given the high demand for the band
  - What is driving the requirement for these high power levels?

Additional requirements for commercial applications

- Create central AFC which all access points must connect to, require AFC everywhere (all bands, all locations)
- A registered beacon fence device allows commercial users to broadcast a signal that informs access points in their fence area not to transmit or allow transmission.
  - This addresses the problem of AFC with mobile devices
  - It also addresses the hidden node and rogue AP problem
- DAA capability required in all new unlicensed broadband devices

Discussion

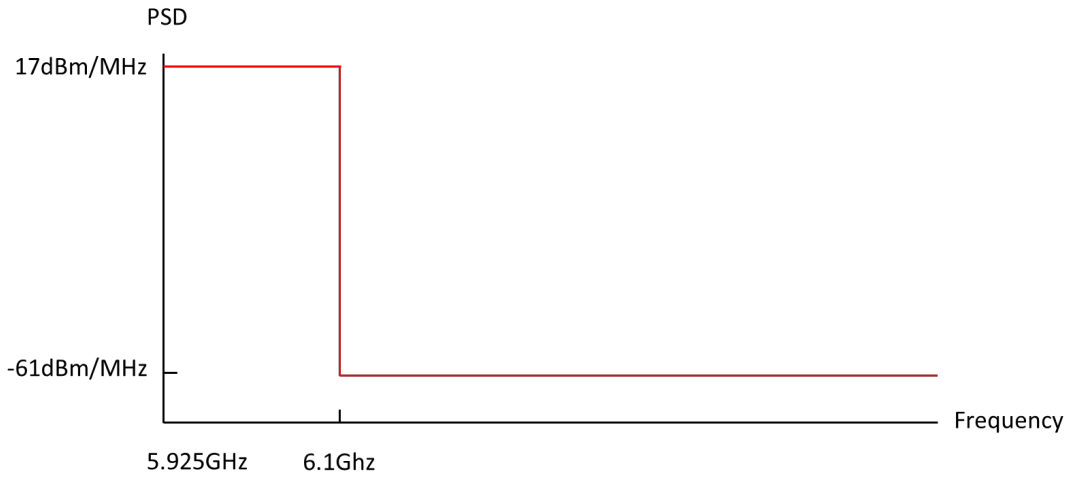
We are interested in your thoughts on these proposals

- Further discussions prepared:
  - Coexistence #1 – Authorize Wi-Fi band from 5.925-6.1 GHz
    - Analysis behind -61.3 dBm/MHz OOBE for 5.925-6.1 GHz
  - Coexistence #2 – Duty cycle limitation held to 0.5%
    - Analysis of power limitation/standoff distances to prevent UWB interference
    - Analysis of effect of duty cycle on interference via Monte Carlo simulation

Details on Coexistence Suggestions

Authorizing Top of Band to 6.1 GHz With Tight OOBE

- No duty cycle limit required
- Even with 6.1 GHz limit, -27 dBm OOBE in NPRM results in a loss at victim receiver of 99% at 3 m
- -61 dBm/MHz OOBE PSD recommended for coexistence
- Massive aggregation expected



	UWB Range Loss vs Distance and OOBE PSD EIRP			
Distance to AP (m) -> OOBE PSD (dBm/MHz)	3	5	10	15
-41	74%	59%	33%	19%
-46	56%	37%	15%	8%
-51	35%	18%	6%	3%
-56	16%	7%	2%	1%
-61	6%	2%	1%	0%
-66	2%	1%	0%	0%
-71	1%	0%	0%	0%

Reasoning behind coexistence suggestions

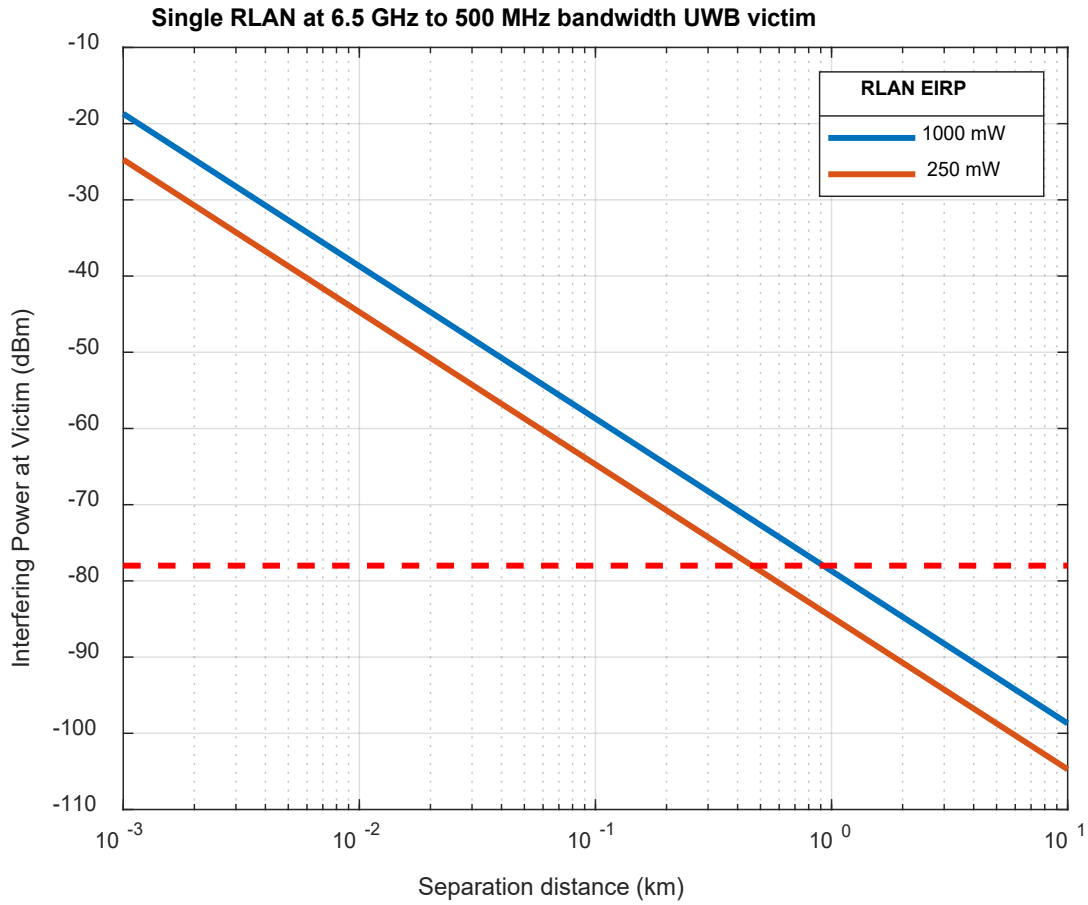
- Start with RKF study assumptions to examine likelihood of interference
- Transmit output power assumptions (by percentage)

EIRP (mW)	1000	250	100	50	13	1
Indoor	0.67%+042%	10.39%	6.49%	24.64%	51.84%	5.56%
Outdoor	2.83%+2.02%	9.45%	9%	32.13%	41.99%	2.58%

- Duty cycle assumptions:
  - 10 devices per person – one device at 0.44% duty cycle, 9 at 0.00022%
- Changed device adoption assumption
  - 95% 6 GHz enabled because we need confidence beyond 2025 time horizon of RKF study

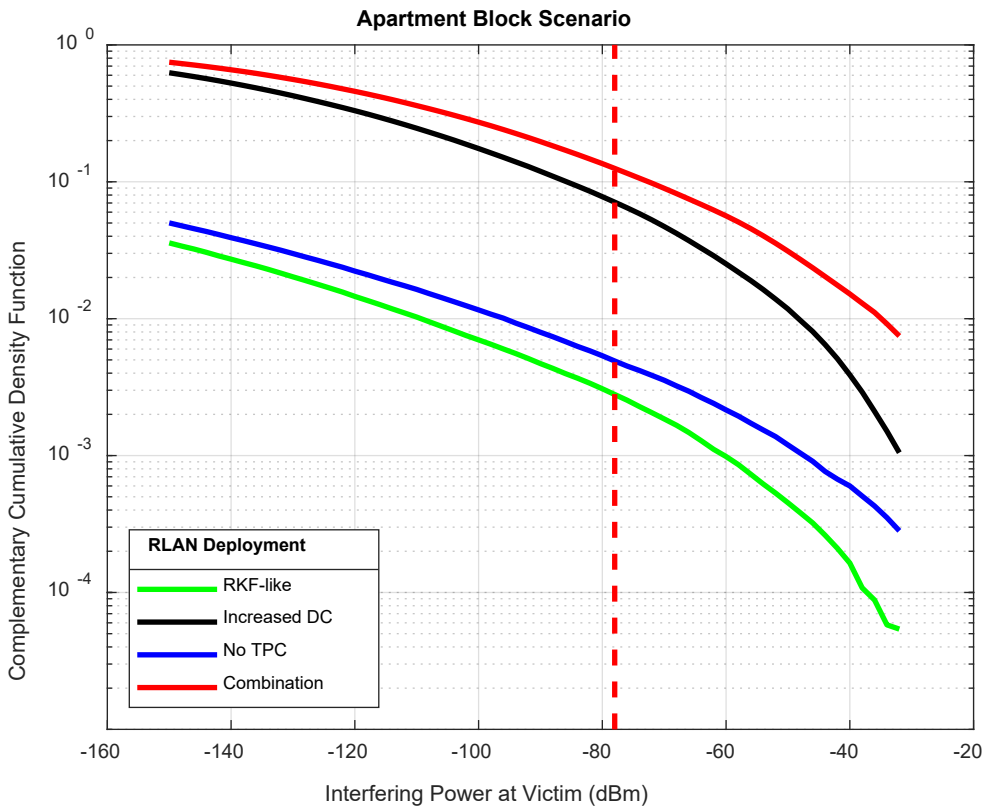
At power levels in NPRM, standoff distances to prevent interference are very large

- Using 3 dB degradation in UWB device performance as tolerable interference threshold
- Need almost 1 km standoff from unlicensed broadband device to allow UWB devices to operate
- Even limiting to 250 mW is a large standoff; power alone can’t solve the problem



RKF assumptions sensitivity study

- Monte Carlo simulation of 6 GHz Wi-Fi deployment in an apartment building
- With duty cycle at 5% vs 0.5%, no transmit power control, **32%** of UWB two-way ranging exchanges will fail



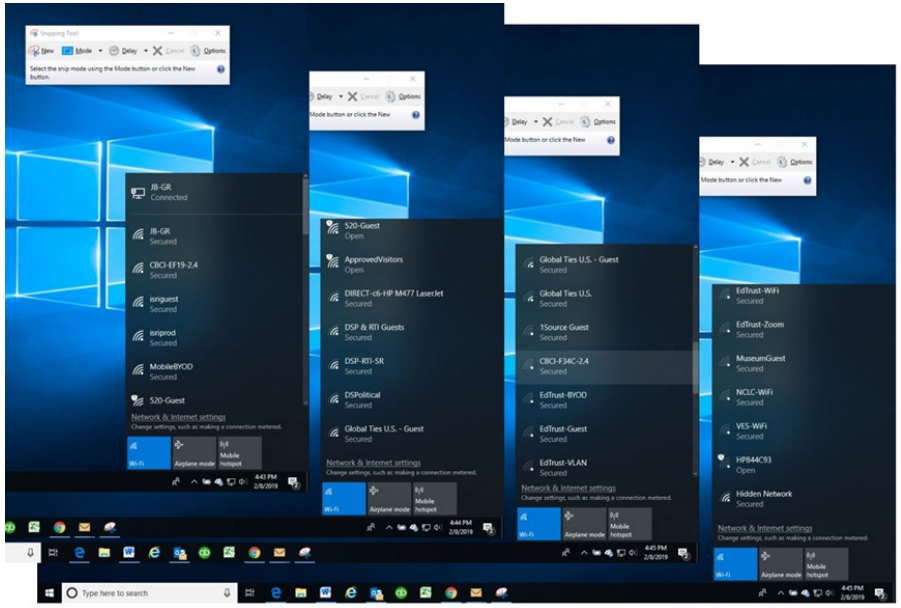
Conclusions:

1) Interference is **extremely** sensitive to duty cycle
2) Transmit power control also plays a role and will increase capacity for all users including Wi-Fi

Assumptions: 95% device adoption by 2025 (higher than initial RKF assumptions), comparing 5% DC to 0.5% DC with TPC and no TPC according to RKF assumptions except using 1 W or 250 mW (not 4 W) max transmit power

Requiring lower power and TPC is a plus for Wi-Fi, UWB, and licensees

- Acknowledging that high power at 6 GHz for rural areas would only be useful for focused point to point links
- Consumer APs typically operate at full power creating congestion, and the need for more bandwidth and power escalation
- Very low power transmissions create less congestion and conserve valuable bandwidth
- Smaller cells yield more capacity



# of SSIDs visible for connection in a typical office on H Street, Washington, DC

Commercial Considerations (Beacon Fence)

- Lower power, duty cycle + TPC can protect consumer devices if they are tolerant to some dropped packets
- Real time audio users of 6 GHz spectrum cannot tolerate this level of dropped packets
- Commercial applications have the benefit of either fixed or mobile but temporarily fixed use
- An RF beacon fence can provide the solution here
  - Beacon is a registered device that broadcasts via already used control frequencies (for easy/cost effective deployment)
  - DAA technology must be required in 6 GHz Wi-Fi devices to prevent transmitting if the beacon signal is received


Thank You For Your Attention
UWB
ALLIANCE
Collectively Creating the Future